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No. 48—1909.

British Engineering Standards Association.

(*Incorporated 1918.*)

FORMED IN 1901 AS THE ENGINEERING STANDARDS COMMITTEE

BY

THE INSTITUTION OF CIVIL ENGINEERS.
THE INSTITUTION OF MECHANICAL ENGINEERS.
THE INSTITUTION OF NAVAL ARCHITECTS.
THE IRON AND STEEL INSTITUTE.
THE INSTITUTION OF ELECTRICAL ENGINEERS.

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BRITISH STANDARD SPECIFICATION FOR WROUGHT IRON OF SMITHING QUALITY FOR SHIPBUILDING.

GRADE D.

LONDON:
PUBLISHED FOR THE ASSOCIATION BY CROSBY LOCKWOOD & SON,
7, STATIONERS' HALL COURT, LUDGATE HILL, E.C. 4; AND 5, BROADWAY, LONDON, S.W. 1,
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May, 1918.

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BRITISH ENGINEERING STANDARDS ASSOCIATION.

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SIR JOHN SNELL	
MR. C. P. SPARKS	
MR. F. R. DAVENPORT	Co-opted by the nominated members to represent the Federation of British Industries.
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MR. C. LE MAISTRE (*Secretary*).

MR. CHARLES DRESSER (*Assistant Secretary*).

* Succeeded the late SIR JOHN WOLFE BARRY, K.C.B., February, 1918.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

The following are lists of members of the Sectional Committee on Sections and Tests for Materials used in the Construction of Ships and their Machinery, and of the Sub-Committee on Iron for Shipbuilding and Ships' Cables, which was entrusted with the drafting of the following Specification.

SECTIONAL COMMITTEE ON SECTIONS AND TESTS FOR MATERIALS USED IN THE CONSTRUCTION OF SHIPS AND THEIR MACHINERY.

September, 1909.

Chairman, MR. ARCHIBALD DENNY.
Admiralty, *Engineer Vice-Admiral H. J. Oram, C.B., R.N.; ¶†Engineer-Commander Philip Marrack, R.N.; Mr. W. E. Smith, C.B.
Board of Trade, ¶‡ Mr. Alexander Boyle.
Institution of Naval Architects, ¶Mr. James Dunn; Mr. W. J. Pratten.
Iron and Steel Institute, Mr. Arthur Cooper.
Institution of Engineers and Shipbuilders in Scotland, Mr. Alex. M. Kennedy; Mr. Alexander Gracie, M.V.O.
North-East Coast Institution of Engineers and Shipbuilders, Mr. Henry Withy; Mr. Summers Hunter.
Steel Ingot Makers' Association, ¶Mr. David Colville; ||Mr. F. W. Dick.
English and Scottish Forge Masters' Association, Mr. A. D. Wedgwood.
Steel Forging Makers' Association, *English and Scottish Steel Founders' Association*, } Mr. Bernard A. Firth.
Lloyd's Register of British and Foreign Shipping, ¶§Mr. Samuel J. P. Thearle; Mr. J. T. Milton.
British Corporation for the Survey and Registry of Shipping, Mr. J. Foster King.
Bureau Veritas, Mr. John Gravell.
South Staffordshire Ironmasters' Association, Sir George Hingley, Bart.
North of England Iron and Steel Manufacturers' Association, ¶Mr. William Thackray.
Scottish Iron Manufacturers' Association, Mr. William Wylie.
Mr. R. J. Butler, C.B. (*John Spencer & Sons, Ltd.*); Mr. James McKechnie (*Vickers, Sons & Maxim, Ltd.*); Mr. Thomas Putnam (*Darlington Forge Co., Ltd.*); ¶Mr. J. Hamilton Turner (*P. & W. MacLellan, Ltd.*); Mr. John Watson (*Steel Company of Scotland*); Prof. W. C. Unwin.

* Succeeded Sir John Durston, K.C.B., R.N., January, 1908.
† Succeeded Mr. R. J. Butler, C.B., February, 1909.
‡ Succeeded Mr. P. Samson, C.B., I.S.O., March, 1909.
|| Deceased May, 1909.
§ Succeeded Mr. H. J. Cornish, June, 1909.
¶ Since deceased.

SUB-COMMITTEE ON IRON FOR SHIPBUILDING AND SHIPS' CABLES.

September, 1909.

Chairman, MR. HENRY WITHY.
Mr. Archibald Denny (*ex-officio*).
Admiralty, Mr. W. E. Smith, C.B.
Board of Trade, ¶*Mr. Alexander Boyle.
Lloyd's Register of British and Foreign Shipping, ¶†Mr. Samuel J. P. Thearle; Mr. J. T. Milton.
British Corporation for the Survey and Registry of Shipping, Mr. J. Foster King.
Bureau Veritas, Mr. John Gravell.
South Staffordshire Ironmasters' Association, Sir George Hingley, Bart.
North of England Iron and Steel Manufacturers' Association, ¶Mr. William Thackray.
Scottish Iron Manufacturers' Association, Mr. William Wylie.
Prof. W. C. Unwin.

* Succeeded Mr. P. Samson, C.B., I.S.O., March, 1909.
† Succeeded Mr. H. J. Cornish, June, 1909.

PREFACE.

The Sectional Committee on Ships' Sections was appointed by the Main Committee on July 19th, 1901.

Having, in conjunction with the Sectional Committee on Bridges and the Sectional Committee on Railway Rolling Stock Underframes, completed the Standard Lists of Rolled Sections for Structural Purposes, the Committee next dealt with Standard Specifications for Iron and Steel Material used in Shipbuilding. For this purpose the Committee was considerably enlarged.

A Sub-Committee was appointed on February 7th, 1907, to draw up a Standard Specification for Iron of Smithing quality for Shipbuilding, and this appointment was approved by the Main Committee on March 7th, 1907.

The Specification drawn up by the Sub-Committee was submitted to the Sectional Committee on Sections and Tests for Materials used in the construction of Ships and their Machinery, and adopted by them at their Meeting on July 2nd, 1909.

This Report was approved by the Main Committee at their Meeting on July 22nd, 1909.

Note.—*The Association desires to call attention to the fact that this Specification is intended to include the technical provisions necessary for the supply of the material herein referred to, but does not purport to include all the necessary provisions of a Contract.*

BRITISH STANDARD SPECIFICATION FOR WROUGHT IRON OF SMITHING QUALITY FOR SHIPBUILDING. GRADE D.

Classification of Iron.

1. Wrought Iron of Smithing Quality for Shipbuilding shall be of Grade **D.**

Quality of Material.

2. The whole of the iron supplied is to be of the description known as "puddled" wrought iron. In no case will steel be allowed to be used as a mixture, and its presence in any specimens under this Specification will involve the rejection of the material represented.

Freedom from Defects.

3. The Bars must be well and cleanly rolled to the dimensions and sections specified, sound and free from flaws, cracks, crop ends, and defects of any description. Any Bars which do not hold up to the full dimensions from end to end, or which have rough, jagged, or imperfect edges or ends will be rejected.

Hot Straightening.

4. All bars shall be hot straightened in the usual way before cooling.

Testing and Inspection.

5. The following tests and inspections shall be made at the place of manufacture prior to despatch; but in the event of any of the material proving unsatisfactory in the course of being worked, such material shall be rejected, notwithstanding any previous certificate of satisfactory testing, and such further tests of the remainder of the material may be made as the Inspector in attendance may consider desirable

Tensile Tests and Test Pieces.

6. The tensile strength and ductility shall be determined from Standard Test Pieces cut from the Bars, in accordance with the following table :—

TENSILE TESTS FOR WROUGHT IRON.

GRADE D.

Section.	Area.	Tensile Strength. Tons per sq. in.	Minimum Elongation per cent.				
			Test Piece A.	Test Piece B.		Test Piece F.	
				As Rolled.	Turned Down.	As Rolled.	Turned Down.
ROUNDS, SQUARES AND FLATS.	2 sq. ins. and under.	21 to 24	16	16	13	20	17
	Over 2 sq. ins.	20 to 23	14	14	11	18	15

All test pieces shall be selected by the Inspector, and tested in his presence. Any straightening of test pieces which may be required shall be done cold.

For Flat Bars a Standard Test Piece having a gauge length of 8 inches (Test Piece **A**, *see* Appendix, page 12), and for round Bars a Standard Test Piece having a gauge length of 8 times the diameter (Test Piece **B**, *see* Appendix, page 13), shall be used. Where bars are above 1 inch in diameter, and are tested full size as rolled, or have been turned down, and the resulting test piece is above 1 inch in diameter, a Standard Test Piece having a gauge length of not less than 4 times the diameter (Test Piece **F**, *see* Appendix, page 14) may be used.

Wherever practicable the rolled surface shall be retained on two opposite sides of a flat test piece.

Should a tensile test piece break outside the middle half of its gauge length, the test may, at the Maker's option, be discarded, and another test be made of the same bar.

Number of Tensile Tests.

7. One tensile test shall be taken from each batch of 50 bars, or less, of any one size, or one test from each 2 tons, or less, of any one size whichever method gives the larger number of test pieces.

Nicked Bend Test.

8. Nicked bend tests shall be made on test pieces cut from the bars as rolled. The test piece shall be lightly and evenly nicked on one side with a sharp cutting tool and bent back at this point through an angle of 180 degrees by pressure in a press or by a succession of light blows. It shall show a clean fibrous fracture, free from slag or dirt or any coarse crystalline structure.

Cold Bend Test.

9. Test pieces must withstand being bent cold through an angle of 90 degrees by pressure or by a succession of light blows over a round bar equal in diameter to $1\frac{1}{2}$ times the thickness of the test piece without showing signs of fracture on the outside of the bent portion.

Hot Bend Test.

10. A test piece heated to a bright red must withstand, without showing signs of cracks or flaws, being bent flat on itself by pressure or by a succession of light blows and without hammering directly on the bend.

Number of Bend Tests.

11. One hot, one cold, and one nicked, bend test shall be taken for each tensile test made.

Additional Tests before Rejection.

12. Should either a tensile or bend test fail to fulfil the test requirements and the Inspector agrees that the test piece does not fairly represent the quality of the material, two duplicate specimens may, if the Maker wishes, be tested, and if the results obtained from both are satisfactory the quality of the material shall be judged therefrom and not from the original test which failed. If, however, either of the duplicate tests fails, the material represented should be rejected.

Inspection.

13. The Inspector shall have free access to the works of the Manufacturer at all reasonable times; he shall be at liberty to inspect the manufacture at any stage, and to reject any material that does not conform to the terms of this Specification.

Testing Facilities.

14. The Manufacturer shall, at his own cost, furnish and prepare the necessary test pieces, and supply labour and appliances for such testing as may be carried out on his premises in accordance with this Specification. Failing facilities at his own works for making the prescribed tests the Manufacturer shall bear the cost of carrying out the tests elsewhere

APPENDIX.

FORMS

OF

BRITISH STANDARD TENSILE TEST PIECES.

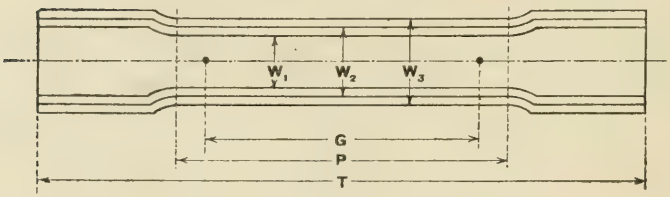
APPENDIX.

FORMS

OF

BRITISH STANDARD TENSILE TEST PIECES.

TEST PIECE **A.**

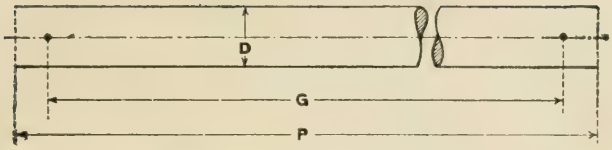


Gauge Length **G** = 8 inches.
Parallel Length **P** to be not less than 9 inches.
Total Length **T** = About 18 inches.

Thickness of Test Piece.	Maximum Width allowed.
Over $\frac{7}{8}$ in. (0·875 in.)	$W_1 = 1\frac{1}{2}$ ins.
$\frac{3}{8}$ in. (0·375 in.) to $\frac{7}{8}$ in. (0·875 in.)	$W_2 = 2$ ins.
Under $\frac{3}{8}$ in. (0·375 in.)	$W_3 = 2\frac{1}{2}$ ins.

The widths of the test pieces for plates were selected to comply with the two following conditions. (1) As the great bulk of plates to be tested are from $\frac{3}{8}$ inch to $\frac{7}{8}$ inch thick, it was desirable for the sake of convenience that the test pieces for such plates should be of uniform width, and, in accordance with very general practice, a width of 2 inches was selected. (2) With a test piece of a given form, the percentage of elongation was found to be less for thick plates than for thin ones; with steel of the same quality in other respects it was desirable therefore to choose widths of test piece which would be slightly in favour of the thicker plates. This is secured with the widths selected for the Standard Test piece of form **A.**

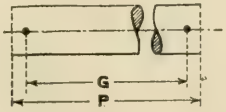
TEST PIECE **B.**



Gauge Length **G** to be not less than 8 times the diameter **D**.
With enlarged ends :—Parallel Length **P** to be not less than 9 times the reduced diameter **D**.

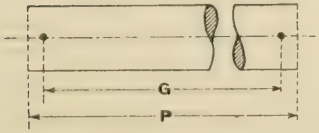
All test pieces of form **B** are strictly similar, and for the same material give the same percentage of elongation. They are nearly similar to a test piece of form **A**, 8 inches in gauge length, 2 inches wide and $\frac{3}{8}$ inch thick.

TEST PIECE **C.**



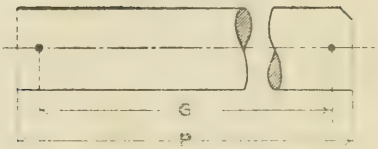
Gauge Length **G** = 2 inches.
Parallel Length **P** to be not less than $2\frac{1}{4}$ inches.
Dia. = 0·564 inch.
Area = $\frac{1}{4}$ sq. inch.

TEST PIECE **D.**



Gauge Length **G** = 3 inches.
Parallel Length **P** to be not less than $3\frac{3}{8}$ inches.
Dia. = 0·798 inch.
Area = $\frac{1}{2}$ sq. inch

TEST PIECE **E.**

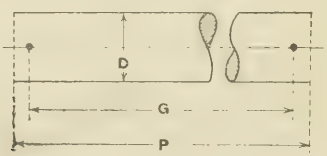


Gauge Length **G** = $3\frac{1}{2}$ inches.
Parallel Length **P** to be not less than 4 inches.
Dia. = 0·977 inch.
Area = $\frac{3}{4}$ sq. inch.

Test Pieces **C, D,** and **E** were arranged to meet the very common practice of making test pieces for forgings, axles, tyres, etc., of either $\frac{1}{4}$ square inch or $\frac{1}{2}$ square inch in sectional area. With the gauge lengths decided upon these three forms are very nearly similar, and, for a given material, give very approximately the same percentage of elongation. Though not exactly, they are approximately similar to the Standard Test Piece **F,** and for the same material give a nearly identical, but slightly greater, percentage of elongation.

TEST PIECE **F.**

(For Test Pieces over 1 inch diameter.)



Gauge Length **G** to be not less than 4 times the diameter **D.**
With enlarged ends:—Parallel Length **P** to be not less than $4\frac{1}{2}$ times the reduced diameter **D.**

In some testing machines it was found inconvenient to use form **B** for bars of over 1 inch in diameter, and form **F** of half the gauge length is designed to meet such cases. For a given material the percentage of elongation with Test Piece **F** is greater than with Test Piece **B;** and this difference is provided for in the British Standard Specifications.

FORM OF ENDS.

In the case of the round Test Pieces **B, C, D, E** and **F,** the form of the ends is to be as required in order to suit the various methods employed for gripping the test piece. When enlarged ends are used the length of the parallel portion of the test piece must in no case be less than that noted on the diagrams.

British Engineering Standards Association.

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OF

BRITISH STANDARD SPECIFICATIONS AND REPORTS.

NOVEMBER, 1919.

(This List cancels all previous Lists.)

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